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THE PAST AND PRESENT DISTRIBUTION AND STATUS OF SEA LIONS AND FUR SEALS IN WESTERN AUSTRALIA

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ABSTRACT

A comparison of the distribution and abundance of seals in Western Australia, according to accounts by early navigators and colonists with surveys made in 1974-7 shows that the Fur seal *Arctocephalus forsteri* (Lesson) has contracted in both distribution and abundance, whereas the Sea lion *Neophoca cinerea* (Péron) has declined only in abundance. The largest known Sea lion populations now occur on Beagle, Buller, Fisherman, Carnac, Middle Doubtful, Wedge and Daw Islands. The largest known Fur seal populations are on Eclipse and Middle Doubtful Islands, and on several islands in the Archipelago of the Recherche. The total size of Western Australian populations is about 700 Sea lions and about 400-500 Fur seals.

The abundance of the Sea lion on Carnac I. was monitored over three years, and was found to range from 25-32 animals. On Middle Doubtful Island both species of seal were present but were ecologically segregated. All Fur seals were found around the rocky shores, whereas Sea lions ascended as far as the summit (80m).

INTRODUCTION

Once the coastline of South-western Australia was charted by Vancouver in 1791, British, Colonial and North American sealers were quick to move in and exploit the local seal populations, which comprised only two species. Sealing there was never subjected to any sophisticated control by sealers or by the British Government (Lockyer, 1827), with the inevitable result that the supply of both species of seals declined markedly by the 1830s. All the commonsense rules of harvesting a

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renewable resource were broken: the young as well as females were taken just as readily as males, and where possible all individuals on a single island were collected.

Because the pelt of the Fur seal (*Arctocephalus forsteri*) has a thick underfur in contrast to the coarse hair of the Sea lion (*Neophoca cinerea*), the skins of the former were in 1842 worth 15 shillings each at King George Sound, and two pounds and twenty five shillings in London, whereas those of the Sea lion fetched only 4-5 shillings each (Clark 1842). This probably also accounted for the greater hunting pressure on the Fur seal.

In this paper, I report on the following:

(1) The past distribution and abundance of both pinniped species in Western Australia, gathered from a search of the reports of the early navigators and early colonists.

(2) The current distribution and abundance of both seal species in Western Australia, derived mainly from a study in 1974-7 of island birds which enabled me to work on many islands between Shark Bay and the Archipelago of the Recherche. I have supplemented these data with published records.

(3) The population of Sea lions on Carnac I. (near Perth) was counted in 1975-7 to see whether a seal population fluctuated over several years. I also include data on day-to-day variation in numbers.

(4) Differences in the way that Fur seals and Sea lions use Middle Doubtful I. (near Bremer Bay) were studied. I also remark on the effect that Sea lions can have on island ecology.

PAST DISTRIBUTION AND ABUNDANCE OF PINNIPEDS IN WESTERN AUSTRALIA

There are no past records of seals breeding on the mainland of Western Australia. For convenience, I have grouped the islands around South-western Australia into nine groups (**Fig. 1**). All records in this Section refer to the 18th and 19th centuries.

SHARK BAY ISLANDS (**Fig. 1-A**):

Fur seal: no records.

Sea lion: There is only one record of a seal on rocks at Dirk Hartog I. in January 1822 (A. Cunningham in King 1827: 183). Baudin (in Cornell 1974: 512) wrote 'we have never seen a single seal here'. Péron (1807: 104-127), Freycinet (1807) and Péron and Freycinet (1816, Ch.30) also make no mention of any seals.

HOUTMAN ABROLHOS (**Fig. 1-B**):

Fur seal: no records.

Sea lion: The present day Long I. in the Wallabi Group was called Seal's I. by the survivors of the *Batavia* wreck in 1629 (Drake-Brockman 1963), presumably

indicating a great abundance of Sea lions there. Survivors of the *Zeewyk* shipwreck in 1727 killed 147 Sea lions on the islands in the Pelsart Group (O'Loughlin 1969: 26). Gilbert (1843) noted that all the islands in the Wallabi Group were 'very thickly inhabited' by Sea lions, and that 'greater numbers' were seen on Pelsart I. A few Sea lions on Pelsart and Rat Is. were noted by Stokes (1846) when he charted the Abrolhos in April/May 1840.

ISLANDS BETWEEN DONGARA AND LANCELIN (**Fig. 1-C**):

I have found no detailed records of seals from these islands.

ISLANDS NEAR PERTH (**Fig. 1-D**):

Fur seal: Freycinet (1807: 189) saw a female seal suckling a black pup on Rottnest I. He recorded that the fur of most animals was fine and thick, which suggests the Fur seal. However, King (1827: 163) wrote that at Rottnest 1., he was 'much disappointed in finding these animals were not of the fur seal species, as in M. de Freycinet's account of the island they are said to be'.

Sea lion: The Dutch navigators Voelkersen in 1658 and Vlamingh in 1696 recorded seals at Rottnest I., presumably of this species (Alexander 1914). Freycinet (1807: 184) noted that Garden I. was covered with a great number of seals, of which many were slaughtered. Seals were more numerous there than on Rottnest I. (Freycinet 1807: 191). At what is now called the Heirisson Is. (near the city of Perth), some of the crew heard (Freycinet 1807: 183) what must have been a seal. In January 1822, King (1827) found 'a great many' Sea lions on Rottnest 1. Stirling (1827: 571) noted many seals on islands near Perth, and stated that all were Hair seals. In 1829, Lt. Breton saw 'an occasional seal' on Garden I. (Alexander 1918: 38), and T.B. Wilson saw one there (Alexander 1918: 39). Penguin I. was stated by Clark (1842) to be a 'favorite resort' of the Sea lion. Presumably they also occurred on Seal I. just north of Penguin I.

ISLANDS NEAR CAPE LEEUWIN: (**Fig. 1-E**):

Fur Seal: Irwin in 1832 (Alexander 1918: 46) noted many Fur seals on these islands. Clark (1842) stated that on the voyage from Perth to Albany, Fur seals were first sighted on these islands.

Sea lion: I could find no records of Sea lions on these islands.

ISLANDS BETWEEN POINT D'ENTRECASTEAUX AND PT. HILLIER (**Fig. 1-F**):

Fur seal: Sandy I. was frequented 'in great numbers' by the Fur seal (Clark 1842). Clark also recorded Fur seals on Chatham, Saddle and Goose Is. None was recorded on Stanley I.

Sea lion: I have found no records of Sea lions occurring on these islands.

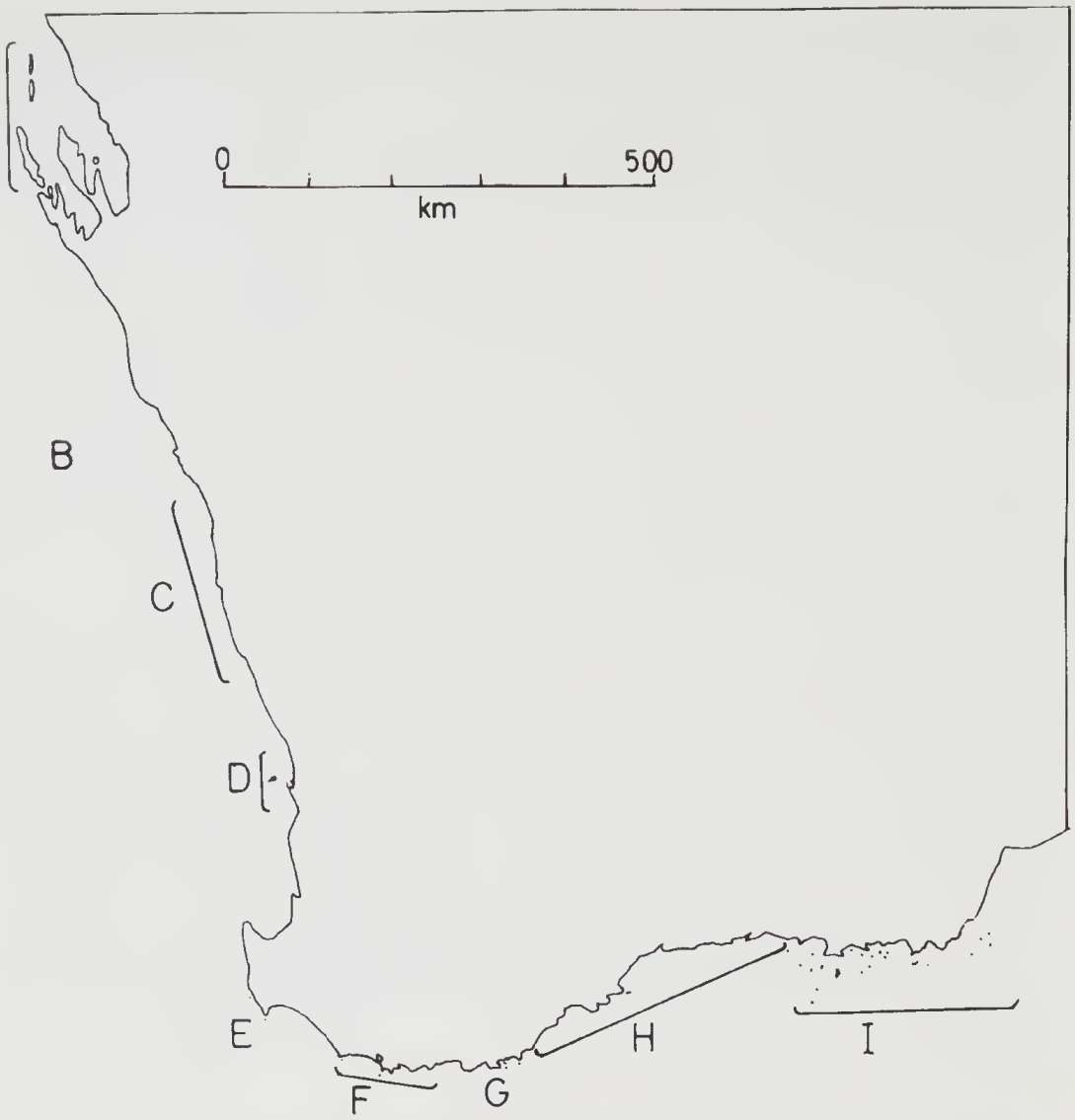

FIG. 1: Map of South-western Australia showing island groups referred to in text. **A** = Shark Bay islands; **B** = Houtman Abrolhos; **C** = Dongara-Lancelin; **D** = near Perth; **E** = near Cape Leeuwin; **F** = Point d'Entrecasteaux to Point Hillier; **G** = Torbay to Coffin I.; **H** = Bald I. to Butty Head; **I** = Archipelago of the Recherche.

ISLANDS BETWEEN TORBAY AND COFFIN I. (**Fig. 1-G**):

Fur seal: King (1827) did not record Fur seals at King George Sound, but Lockyer (1827) noted them on Breaksea I. (one dozen) and on Michaelmas I. Sleeman (1829: 542) recorded that 12 Fur seal skins, 11 Sea lion skins and 29 pup skins were procured at King George Sound on 16th February 1829. Eclipse I. was much frequented by Fur seals, and sealers lived on the island (Lockyer 1827, Clark 1842). Collie (in

Cross 1833: 150) found no live seals on Coffin I. in June 1831, but found skeletons and only one path.

Sea lion: Vancouver (1801) in September 1791 named Seal I. in King George Sound because of the Sea lions there, of which at one time he counted 20 animals. Seals were still there in December 1801 (Flinders 1814), in February 1803 (Péron and Freycinet 1816: 141) and in January 1818 and December/January 1822 (King 1827). None was present on 28th January 1827 (Lockyer 1827: 478).

ISLANDS BETWEEN BALD I. AND BUTTY HEAD (**Fig. 1-H**):

Bald I. was frequently inhabited by sealers (Clark 1842). I found no published data for Haul-off Rock or Cheyne, Glasse, Doubtful, the two Red, Rocky or West Is.

ISLANDS IN THE ARCHIPELAGO OF THE RECHERCHE (**Fig. 1-I**):

Fur seal: In December 1792 La Billardière (1800: 422-3) observed several Fur seals on Observatory I. He specifically stated that all seals were of the one species, the small one (p.425). However, he described their colours as white, dark grey or brown approaching black, thus suggesting that Sea lions occurred too.

Sea lion: Flinders (1814) stated that all of the islands in this Archipelago were 'more or less frequented by seals'. Most were stated to be Hair seals (= Sea lions). The islands in the Recherche were said to be a great rendezvous of sealers (Clark 1842). Lockyer (1827: 498-9) mentions the instance of sealers, left for 18 months on the coast near the islands, as having 100 Fur seal pelts when they arrived at King George Sound. A further 700 skins were left on an island in the Archipelago.

Thus, in summary, before the advent of the sealers, Fur seals ranged from the Archipelago of the Recherche to islands off Cape Leeuwin. Sea lions were found from this Archipelago to Houtman Abrolhos, with a record of a presumed vagrant at Dirk Hartog I. in 1822.

CURRENT DISTRIBUTION AND ABUNDANCE OF PINNIPEDS IN WESTERN AUSTRALIA

This is chiefly based on two-week long visits to the following islands by the author: Bernier, Dirk Hartog, East Wallabi, Pelsart, Rottnest, Carnac, Garden, Hamelin, Sandy, Chatham, Eclipse, Breaksea, Michaelmas, Bald, Middle Doubtful, Woody and Mondrain Islands. Brief visits (several hours to three days) were made to: Eagle Islet, Shark Bay; West Wallabi, Seagull, Pigeon, Long, Beacon, and Gun Is. (Houtman Abrolhos); Boullanger, Whitlock, and Eclipse Is. and Essex Rocks (Jurien Bay); Lancelin and Edward Is.; nearly all (121) islands and islets near Perth; nearly all (13) islands in or near King George Sound, Coffin I., West Doubtful I., and Wilson and Salisbury Is. (Archipelago of the Recherche). In addition, informa-

tion is included from other scientists' visits to Bernier and Dorre Is. (Ride and Tyndale-Biscoe 1962), Houtman Abrolhos (Storr 1960, 1965; Anon. 1964, 1965; O'Loughlin 1969; Green 1972), Fisherman Is. (R.E. Johnstone in Chapman and Kitchener 1977), islands between Dongara and Lancelin (Ford 1963, 1965, unpublished), Bald I. (Storr 1965), the Archipelago of the Recherche (Serventy 1953, Lindgren 1956, King 1969, Shaughnessy 1970), and S. Fowler's flights in 1945 over various islands (R.M. Warneke, pers. comm.).

There is one known mainland breeding site (Reilly 1974 and pers. comm.). On 22 October 1973, three males, 14 females and five suckling young Sea lions were found at the base of the cliffs 4 km west of Twilight Cove. All other breeding records pertain to islands.

SHARK BAY ISLANDS:

Ride and Tyndale-Biscoe (1962: 85) saw no seals on Dorre or Bernier Is., and I saw none on Bernier or Dirk Hartog Is.

HOUTMAN ABROLHOS:

Sea lions are now uncommon. Alexander (1922) records, without details, only a few individuals. I saw none during the month that I spent there (October 1975). Storr (1960, 1965) quotes several sightings on North I., and one sighting near West Wallabi. He found the remains of a male on West Wallabi. One bull, one cow and two pups were seen on Jubilee I., and a "small group" was seen on Gun I. in the Pelsart Group (O'Loughlin 1969: 26). One was seen off Pigeon I. in the Wallabi Group (Anon. 1964: 23). However none was seen on five islands in the Wallabi Group in 1965 (Anon. 1965) or in the Easter and Pelsart Group in 1970 (Green 1972). Several were present on Long I. in the Wallabi Group when Bill Peach filmed a documentary there (Peach's Australia), but no further details are available. Two Sea lions were present on an islet on Morning Reef on 27.5.78, and small groups have been seen there on other occasions by Museum staff (B.R. Wilson, pers. comm.). Local fishermen today use the name 'Seal Island' for this small, divided islet. There are specimens from Rat and West Wallabi Islands in the collections of the Western Australian Museum.

ISLANDS BETWEEN DONGARA AND LANCELIN:

I found two Sea lions on North Essex rock. Julian Ford (pers. comm.) has recorded Sea lions as follows: Beagle Islets (about 50, 26.5.61), Fisherman Is. (about 40, 12.12.61), Sandland I. (about 20, 15.7.62), North Essex rock (3-4 on three visits), South Cervantes I. (18, with suckling young on 28.10.61, but only two on 29.10.62), Buller I. (30 on 28.10.61, 14 on 30.12.62), Green Islets (no counts made). R.E. Johnstone has visited the Fisherman Is. over 30 times since 1971 at all times of the year. Numbers ranged from 5-52 (Chapman and Kitchener 1977). S. Fowler

recorded two on North Cervantes I. in June 1945, 22 on North Fisherman I. in July 1945 and one on South Green It. in June 1945.

ISLANDS NEAR PERTH:

Sea lions are said to occur on Dyer I. (near Rottnest), but none was present on both my visits. However, John Turner (pers. comm.) visited Dyer 1. briefly each month during 1975, and found one old bull present each visit. Sea lions are now extinct on Rottnest and Garden Is., but a stable population (20-30 seals) occurs on Carnac I. (see below). I have seen single seals or their faeces on Bird I., West Tub Rock and West Sister 1. There are specimens in the Western Australian Museum from Swanbourne Beach, Woodman Point, Robb Jetty, Yanchep, Lake Preston and Penguin I.

ISLANDS NEAR CAPE LEEUWIN:

Fur seal: now extinct. I saw none on Hamelin I., and Gillham (1963) did not record any from Hamelin, Seal or St. Alouarn Is. J. Lane (pers. comm.) has not seen any on several recent (1976) visits to St. Alouarn.

Sea lion: no records.

ISLANDS BETWEEN POINT D'ENTRECASTEAUX AND PT. HILLIER:

Fur seal: extinct on Sandy and Chatham I. None was seen on the White-topped Rocks or Goose I., which were flown over at low altitude in April 1977. None was seen on Stanley I. when viewed through binoculars from Pt. Hillier. Occasionally a Fur seal comes ashore at Windy Harbour (D. Beale, pers. comm.)

Sea lion: no records.

ISLANDS BETWEEN TORBAY AND COFFIN I.:

Fur seal: Seventy were counted in April 1975 on Eclipse I., where most were in a gorge at the N.E. corner of the island. Two or three seals were occasionally seen on the southern shores of the island. King (1969) found pups on Eclipse I. in 1967. One was seen on Breaksea I., and two (including a pup) on Michaelmas I. These probably represent strays. There are certainly no rookeries on these two islands. Four seals were seen, at close range, on Rock Dunder. On Coffin I. 15 were present. Sokolowski (1976) recorded 29 in May 1976 on Coffin I., and stated that he had counted 50 seals there at other times. However, these were identified (erroneously) as Sea lions.

Sea lion: extinct on Seal I. A few were reported to occur on Eclipse I. by the lighthouse staff, though none was present during my visit. King (pers. comm.) saw three adult males, one subadult male, and 3-4 juvenile males or females on Eclipse I. in February 1967. However these were casual sightings and not necessarily the total island population. There were no Sea lions present on Breaksea, Michaelmas, Mistaken, Coffin or Green (Oyster Harbour) Is., or on Rock Dunder or Gull Rock.

ISLANDS BETWEEN BALD I. AND BUTTY HEAD:

Fur seal: on Bald I., about half way down the eastern side, were 15 Fur seals on a small rock about 5m high, just offshore. I also saw one Fur seal on a small rock off the southern side of the island. On Middle Doubtful I., 86 Fur seals were counted (details below), and on West Doubtful I. four were seen in pools of water. S. Fowler in May 1945 saw about 80 unidentifiable seals on Rocky Is.; from the similarity of these islands to the Doubtful Is. I would expect most of these to be Fur seals.

Sea lion: on Bald I., I found one dead at the landing place, and I saw three animals (in water) on 19th May 1976. Half way down the eastern side of the island I found old faeces and bones which represent a haul-out site of this species. Storr (1965) recorded a subadult male on Bald I., and noted them as common at nearby Cheyne Beach. Trails of this species could be clearly seen all over Haul-off Rock when I flew over this island in April 1977. D. Pearson of Albany (pers. comm.) has noted them as being very common on this island. S. Fowler recorded about 40 Sea lions on Haul-off Rock in June 1945.

On Middle Doubtful I., I counted 41 Sea lions, and I saw old faeces on West and East Doubtful Islands. Seals (?species) are occasionally seen on Glasse I., Bremer Bay and on Seal (or Cruiser) Rock, Doubtful Island Bay (P. Spurr, pers. comm.). S. Fowler recorded about 20 Sea lions on the Smooth Rocks, about 80 on West I. in May 1945, and one on the Rocky Is.

ISLANDS IN THE ARCHIPELAGO OF THE RECHERCHE:

Both species are widespread, but no seals were recorded on the following islands by Serventy (1953) or Bassett Hull (1922): Charley, Rabbit, Gunton, Sandy Hook, Woody, Long, Remark, Pasco, North and South Twin Peaks, and Middle Is. I did not find any on Woody or Wilson Is.

Fur seal: this species has been recorded on Seal Rock (about 150 in July 1945, S. Fowler; at least 100 pups in February 1967, King, pers. comm.; at least 37 animals, Shaughnessy 1970), Fur Rock (about 40 in July 1945, S. Fowler), Hood I. (at least 15 animals, Shaughnessy 1970), and on Daw I., formerly called Christmas I. (100 animals in 1948 and 50 animals in 1950, Serventy 1953; 100 in 1960, King 1969). About 10 animals including one pup in 1977 were present on Salisbury I. King (1969) quotes local information that Figure of Eight, Capps and Boxer Is. have Fur seals present. However her records of Round, Mondrain, Wedge, Middle and Termination Is. as having Fur seals probably represent a mis-reading of Serventy (1953). On Mondrain I. in April 1977, two Fur seals were present on the north-central point. S. Fowler in 1945 counted the following: Douglas, about six in May; George I., 30 in June; Glennie I., about 40 including young in May.

Sea lion: Serventy (1953) recorded Sea lions on thirteen of the 21 islands visited: Figure of Eight (2), Seal Rock (20), Boxer (1), Termination (20, breeding), Thomas

(1), Round (20, breeding), Mondrain (5), Wedge (40, breeding), Combe (10), Goose (1 dead), Douglas (10, breeding), Salisbury (20) and Daw (65, breeding). Lindgren (1956) recorded five Sea lions and three skeletons on Lion I. On Mondrain I., two adult males were seen at the landing place in February 1976, one skeleton was found half way down the eastern coast of the island, and in April 1977, four Sea lions were seen on the north-central point of the island. There are three specimens in the Western Australian Museum from Pasley I. and one from one of the Twin Peaks Islands. In May 1945 S. Fowler recorded Sea lions on rocks close to the mainland at Point Malcolm (12) and Israelite Bay (6). Seals, species not determined, were also recorded by S. Fowler in 1945 on the following additional islands: Helby (3), Hugo (8), Marts Group (8), Slipper (1).

In 1920, sealers took 494 Fur seals and 327 Sea lions in the Archipelago of the Recherche (Serventy 1953).

Thus the present range of the Sea lion in Western Australia corresponds with its range early last century, but the Sea lion has decreased in abundance on islands near the cities of Albany and Perth, and at Houtman Abrolhos. They remain in moderately large numbers on several islands between Dongara and Lancelin. The total population size in Western Australia is about 700 individuals.

The Fur seal is now extinct over a third of its former range in Western Australia (between Cape Leeuwin and Eclipse I.). The total known population size in Western Australia is about 400-500 individuals.

Independent corroboration of my conclusions about distribution along the south coast of Western Australia is given by Barwick (p.95 in Le Souef and Burrell 1926). He records that '. . .every island and the adjacent mainland from the Eastern Group [of the Archipelago of the Recherche] to Eclipse Islands. . .are at frequent intervals visited by both hair- and fur-seals.' This implies that by the 1920s neither species was found along the south coast west of Eclipse I.

SEASONAL AND DIURNAL CHANGES IN ABUNDANCE OF SEA LIONS ON CARNAC I., 1975-7.

I counted the number of Sea lions ashore on the eastern beach of Carnac I. about one hour before dark on eight visits to the island. I spent ten weeks on the island between 1975-7, but neglected to count seals on the first two visits. The counts in **Table 1** represent the largest number of animals hauled out of any count made during that week.

The number of Sea lions present showed remarkable constancy, and only varied from 25 to 32 animals. There was no apparent seasonality in abundance (**Table 1**). The numbers counted each day (one hour before dusk) during the last three visits were as follows:

August/September 1976: 14, 15, 22, 25, 7, 26;
November 1976: 17, 32, 29, 32, 32, 32;
January 1977: 26, -, 26, 23, 27, 28;

Although the numbers in August/September 1976 and in November 1976 showed a marked daily fluctuation in numbers, those in January 1977 were more constant. A possible explanation is that food is more difficult to find in September and November, so that seals have to spend more time hunting for food.

On Carnac I. during the day only a few seals haul-out. This is when many tourists visit the eastern beach. I have never seen seals using the two western beaches, which are hardly ever visited by tourists. The Sea lions on Carnac I. are very tame compared with animals on islands (e.g. Middle Doubtful) that are rarely visited by Man (cf. Ling and Walker 1976, 1977).

TABLE 1

Number of Sea lions counted on Carnac I. over 3 years.

Visit (one week)	Largest number counted during each visit
April/May 1975	27
June/July 1975	26
August 1975	25
September 1975	25
November 1975	30
August/September 1976	26
November 1976	32
January 1977	28

This long term study emphasizes that counts of seal populations made on short visits during the day to islands are likely to be unreliable. Moreover it brings into question the usefulness of making counts from an airplane or boat. King (1969) also acknowledges the unreliability of making counts of Fur seals based on brief visits. The only reliable method would be to camp on the breeding island for at least one week, at various times of the year (cf. Marlow 1968, Stirling 1971).

In January 1977, I tried to age the Sea lion population on Carnac I. All 27 animals were measured from snout to end of tail relative to my own height. Four large animals (one 2.6m long, three others 2.3m) were dark brown with a whitish/yellow cap, and were presumed to be adult males (King 1964). Fifteen animals were brown, but with white caps, and were presumed to be immature (?non-breeding) males (King 1964). Their measurements were: five animals 2.6m long, nine animals 2.3m long and one 2m long. The remaining eight animals were whitish ventrally and

greyish above and did not have any contrastingly coloured cap. Their measurements were 2.5m (four animals), 2m (three animals) and 2.3m (one animal). It proved too difficult to determine the sex of these animals. However, these animals were probably still too large not to be males (J.K. Ling, pers. comm.).

I never observed any small pups on the island or any suckling by animals. I therefore doubt whether breeding takes place on the island. Seals never leave the sandy beach on Carnac I. and venture into the bush; this activity is however commonplace on the islands between Dongara and Lancelin which have breeding populations (Ford 1963, 1965). This also suggests that breeding does not take place on Carnac I.

HABITAT USAGE BY SEA LIONS AND FUR SEALS ON MIDDLE DOUBTFUL ISLAND

On March 11th 1977, I spent 3-4 hours walking around the perimeter of Middle Doubtful I. (area 55ha) counting Fur seals and Sea lions, and walking over the plateaux counting Sea lions. Numbers were recorded on a hand map of the island. The numbers counted, with their localities, are shown in **Fig. 2.** I found about twice as many Fur seals as Sea lions (86: 41 animals). The species were ecologically segregated, as also noted by Stirling (1971).

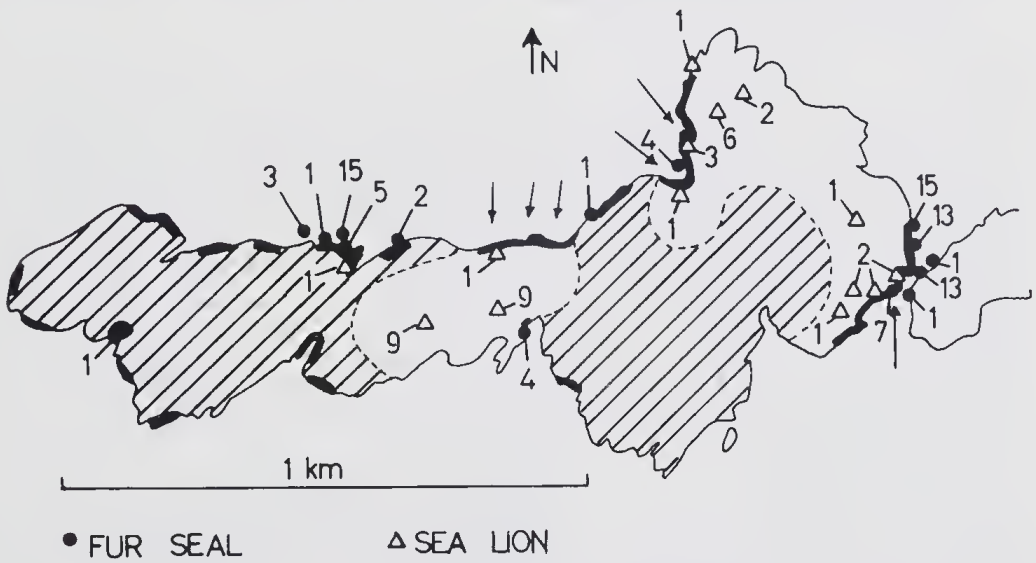

FIG. 2: Map of Middle Doubtful Island, showing distribution and abundance of Fur seals and Sea lions.
The shaded area represents that part of the island not used by Sea lions, as evidenced by absence of dung.
Thickened lengths of coastline represent places where Sea lions could haul out; arrows represent actual haul-out sites (as evidenced by tracks or dung).

FIG. 3: Habitat of Sea lions on Middle Doubtful Island. *Disphyma blackii* herbfield, elevation about 30 m above sea level.

All Fur seals were recorded either in the water, on boulder islets close to the island, or on the rocky shoreline close to the water's edge. Sea lions were mainly encountered away from the shore in small groups (31 out of 41 animals). Fur seals were never observed lying close enough to touch one another (except pups suckling from their mothers), whereas Sea lions were usually clumped together. Presumably, the Fur seal with its dense underfur and black or dark brown coat is likely to suffer heat stress readily and so has to remain near water, whereas the Sea lion (with a paler and less dense coat) is not often under heat stress and so can move inland on islands or rest in clumps (Gentry 1973).

That Sea lions can move well away from the water was apparently first noted on Rottnest I. by Freycinet (1807). Over parts of Middle Doubtful I. the whitened old faeces of Sea lions were widely distributed. I recorded the distribution of these, and constructed (**Fig. 2**) a "dung-line" beyond which seals apparently did not venture. Sea lions did not go more than about 300m from where they hauled out (**Fig. 2**).

Fur seals appear to have no effect on island ecology, but Sea lions have a substantial effect. They haul out and make well defined tracks through the vegetation. The plateau of Middle Doubtful I. is covered with succulent herbfield dominated by

Disphyma blackii. Sea lions do not restrict themselves to the same few square metres each day, so that the vegetation there is little affected. On the sheltered side of the island, however, dense thickets of *Nitraria schoberi* (to 2m) occur. These have been tunnelled through by Sea lions, causing the bushes to take a humped-like arrangement. Ford (1965) found that *Nitraria* thickets on the islands with Sea lions between Dongara and Lancelin had a similar growth form. These islands are much smaller than Middle Doubtful, and Sea lions range completely over them. Ford (1963) considered that the compression of soil by seals and the opening up of the vegetation on islands used by seals had a deleterious effect on lizards.

DISCUSSION

Marlow and King (1974) reviewed the past and present gross distributions of seals in Australian and New Zealand waters. The New Zealand Fur seal is, in New Zealand, increasing its numbers and occupying islands from which it was exterminated by sealers. It should prove interesting to monitor the distribution of the Fur seal in Western Australia to see whether and when it gradually occupies its original range. There is no evidence that this has happened to date.

Shaughnessy (1970) found that Fur seal populations from South and Western Australia were genetically similar (at one locus) to the same species of Fur seal in New Zealand. He suggested that Fur seals in South and Western Australia may have been exterminated by sealers, and that colonization has been from New Zealand. However, complete extermination of all Fur seal populations in Western Australia by sealers seems unlikely. Some of the granite islands off the southern coast of Western Australia are steep and dangerous to land on. Examples are Termination and Pearson Is. in the Archipelago of the Recherche. One wonders whether sealers on a quick landing from a whale boat as described by Clark (1842) could have killed and collected all individuals. This may explain why there are no Fur seals at present on the islands betwee Cape Leeuwin and Eclipse I. Nearly all of these islands have small coves, are inshore and are easily accessible. On the other hand, many of the islands in the Archipelago of the Recherche are steep-sided domes with black algal growth around them up to 10m above sea level.

That seals were widespread and conspicuous in the early days is apparent from there being five named Seal Islands and two Seal rocks off the coastline of Western Australia. These are located in Houtman Abrolhos (now called Long I.), near Jurien Bay (now called Sandland I.), near Perth, off Cape Leeuwin, in King George Sound, and the two Seal rocks are in Doubtful Island Bay and in the Archipelago of the Recherche.

The only island populations in which I observed Fur seal pups were on Eclipse I. (April 1975), Middle Doubtful I. (March 1977) and Salisbury I. (April 1977). Sea

lion pups were found only on Middle Doubtful I. (March 1977). At these times, adult males showed no overt aggression to me, so presumably breeding on these islands takes place at the times recorded for other islands by Marlow (1968) and Stirling (1971, 1972). Stirling found that Fur seals bred in November-January and Sea lions in October on the South Neptune Islands, South Australia. Sea lions also breed in October on Dangerous Reef, South Australia (Marlow 1968). However, in 1975 Ling and Walker (1976, 1977) found new-born Sea lion pups on Kangaroo I. between February and October. In addition, on Fisherman Is., Western Australia, R.E. Johnstone (pers. comm., and in Chapman and Kitchener 1977) has found new-born Sea lion pups present at all times of the year.

The total size of current Western Australian populations of the Fur seal (about 400-500) compares favourably with the 500 animals recently recorded for South Australia (Ling and Walker 1977). However, these authors report a total population size of the Sea lion in South Australia of about 2,300 animals, over three times as many animals as in Western Australia. Why this should be so is unclear.

Middle Doubtful Island, with a large population of both pinniped species, is easily accessible from Bremer Bay. It would be a suitable island on which to study in detail the local biology of both species, so that comparisons with recent studies on South Neptune I., Kangaroo I., and Dangerous Reef (South Australia) could be made.

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REFERENCES

ALEXANDER, W.B. (1914)—History of zoology in Western Australia. Part I. *J. West. Aust. nat. Hist. Sci. Soc.* **5**: 49-64.

ALEXANDER, W.B. (1918)—History of zoology in Western Australia. Part III. *J. Proc. R. Soc. West. Aust.* **3**: 37-69.

ALEXANDER, W.B. (1922)—The vertebrate fauna of Houtman's Abrolhos (Abrolhos Islands) Western Australia. *J. Linn. Soc. Lond. (Zool.)* **34**: 457-486.

ANON. (1964)—*Aquinas College expedition to Wallabi islands of Houtman's Abrolhos.* Perth: Aquinas College.

ANON. (1965)—*Aquinas College second expedition to Wallabi islands of Houtman's Abrolhos.* Perth: Aquinas College.

CHAPMAN, A. & KITCHENER, D.J. (1977)—Mammals of Cockleshell Gully reserve and adjacent areas. *In:* A vertebrate survey of Cockleshell Gully reserve, Western Australia. *Rec. West. Aust. Mus.* Suppl. no. 4: 15-35.

CLARK, W.N. (1842)—*The Inquirer* [Newspaper]. Perth 3rd September, 10th September, 8th October.

COLLIE, A. (1833)—Account of an excursion to the north of King George's Sound, between the 26th April, and the 4th May, 1831. Pp. 132-154 *in* Cross (1833).

CORNELL, C. *Transl.* (1974)—*The journal of Post Captain Nicolas Baudin.* Adelaide: Libraries Board of South Australia.

CROSS, J. (1833)—*Journals of several expeditions made in Western Australia.* London: J. Cross.

DRAKE-BROCKMAN, H. (1963)—*Voyage to disaster: the life of Francisco Pelsaert.* Sydney: Angus & Robertson.

FLINDERS, M. (1814)—*A voyage to Terra Australis.* Vol. 1. London: G. & W. Nicol.

FORD, J. (1963)—The reptilian fauna of the islands between Dongara and Lancelin, Western Australia. *West. Aust. Nat.* 8: 135-142.

FORD, J. (1965)—The avifauna of the islands between Dongara and Lancelin, Western Australia. *Emu* **64**: 129-144; 181-203.

FREYCINET, L.C.D. de (1807)—Chapters 9 and 10 *in* Péron, 1807.

GENTRY, R.L. (1973)—Thermo-regulatory behavior of eared seals. *Behaviour:* **46**: 73-93.

GILBERT, J. (1843)—*The Inquirer* [Newspaper]. Perth 19th April.

GILLHAM, M.E. (1963)—Association of nesting sea-birds and vegetation types on islands off Cape Leeuwin, South-Western Australia. *West. Aust. Nat.* **9**: 29-46.

GREEN, G.A. (1972)—*Fifth Abrolhos expedition 1970.* Perth: Aquinas College.

HULL, A.F. Bassett (1922)—A visit to the Archipelago of the Recherche, S.W. Australia. *Emu* **21**: 277-289.

KING, J.E. (1964)—*Seals of the world.* London: British Museum (Natural History).

KING, J.E. (1969)—The identity of the fur seals of Australia. *Aust. J. Zool.* **17**: 841-853.

KING, P.P. (1827)—*Narrative of a survey of the intertropical and western coasts of Australia.* Vol. 2. London: John Murray.

LA BILLARDIERE, J.J.H. de (1800)—*An account of a voyage in search of La Pérouse.* [English translation.] Vol. 1, Chapt. 9. London: J. Debrett.

LE SOUEF, A.S. & BURRELL, H. (1926)—*The wild animals of Australia embracing the mammals of New Guinea & the nearer Pacific Islands.* London: Harrap.

LINDGREN, E. (1956)—Bird notes on Lion Island, Esperance. *West. Aust. Nat.* **5**: 97-101.

LING, J.K. & WALKER, E.E. (1976)—Seal studies in South Australia: Progress Report for the year 1975: *S. Aust. Nat.* **50**: 59-68, 72.

LING, J.K. & WALKER, G.E. (1977)—Seal studies in South Australia. Progress report for the period January 1976 to March 1977. *S. Aust. Nat.* **52**: 18; 20-27; 30.

LOCKYER, E. (1827)—Journal and report on the newly-formed settlement at King George's Sound. *Hist. Rec. Aust.* (3) 6: 477-501.

MARLOW, B.J. (1968)—The sea-lions of Dangerous Reef. *Aust. nat. Hist.* **16:** 39-44.

MARLOW, B.J. & KING, J.E. (1974)—Sea lions and fur seals of Australia and New Zealand - growth of knowledge. *J. Aust. Mamm. Soc.* **1:** 117-136.

O'LOUGHLIN, P.M. (1969)—*Aquinas College third and fourth expeditions to the Pelsart Group of Houtman Abrolhos.* Perth: Aquinas College.

PERON, F. (1807)—*Voyage de découvertes aux Terres Australes.* Vol. 1. Paris: Imprimerie Impériale.

PERON, F. & FREYCINET, L.C.D. de (1816)—*Voyage de découvertes aux Terres Australes.* Vol. 2. Paris: Imprimerie Impériale.

REILLY, P.N. (1974)—Breeding of Little Penguins along the Great Australian Bight. *Emu* **74:** 198-200.

RIDE, W.D.L. & TYNDALE-BISCOE, C.H. (1962)—The mammals. *In:* The results of an expedition to Bernier and Dorre Islands, Shark Bay, Western Australia in July, 1959. *Fauna Bull. Fish. Dep. West. Aust.* no. 2: 54-97.

SERVENTY, V.N. (1953)—Mammals. *In:* The Archipelago of the Recherche. *Aust. geogr. Soc. Rep.* no. 1 (4): 40-47.

SHAUGHNESSY, P.D. (1970)—Serum protein variation in southern fur seals, *Arctocephalus* spp. in relation to their taxonomy. *Aust. J. Zool.* **18:** 331-343.

SLEEMAN, G. (1829)—Despatch to Colonial Secretary Macleay. *Hist. Rec. Aust.* (3) **6:** 542.

SOKOLOWSKI, R. (1976)—Flora and fauna survey - Coffin Island. *State Wildl. Authority News Service.* 6: 35.

STIRLING, I. (1971)—Studies on the behaviour of the South Australian fur seal *Arctocephalus forsteri* (Lesson). I. Annual cycle, postures and calls, and adult males during the breeding season. *Aust. J. Zool.* **19:** 243-266.

STIRLING, I. (1972)—Observations on the Australian sea lion, *Neophoca cinerea* (Peron). *Aust. J. Zool.* **20:** 271-279.

STIRLING, J. (1827)—Letter to Governor Darling. *Hist. Rec. Aust.* (3) **6:** 551-578.

STOKES, J.L. (1846)—*Discoveries in Australia.* Vol. 2. London. T. & W. Boone.

STORR, G.M. (1960)—The physiography, vegetation and vertebrate fauna of North Island, Houtman Abrolhos. *J. R. Soc. West. Aust.* **43:** 59-62.

STORR, G.M. (1965)—Notes on Bald Island and the adjacent mainland. *West. Aust. Nat.* **9:** 187-196.

STORR, G.M. (1965)—The physiography, vegetation and vertebrate fauna of the Wallabi Group, Houtman Abrolhos. *J. R. Soc. West. Aust.* **48:** 1-14.

VANCOUVER, G. (1801)—*A voyage of discovery to the North Pacific Ocean and round the World.* Vol. 1. London: J. Stockdale.